

# Use of Convalescent Measles Serum to Control Measles in a Preparatory School

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THE suppression of a threatened outbreak of measles in a preparatory school is of importance because of the loss of school days and the inconvenience which may result; neither the incidence of complications nor the attendant seriousness of this disease is as important a factor among the members of this age group as in younger children, but the disease spreads with extreme ease and attempts to control it by the isolation of contacts are relatively futile. The inconvenience which an outbreak of measles may cause and the extent to which it may spread, even when a group is under careful medical supervision, are illustrated in Table I; such experiences have been duplicated frequently among other groups of preparatory school boys.

Since 1918 when Nicolle and Conseil<sup>4</sup> advocated the use of convalescent measles serum as a prophylactic agent it has been frequently used in attempts to control measles, particularly in institutions housing young children. Zingher and Park,<sup>8</sup> Park and Freeman,<sup>5</sup> and many others have reported very satisfactory results from its use; however, because convalescent serum is somewhat difficult to obtain, another effective agent has been sought by various investigators. Tunnicliff and Hoyne<sup>7</sup> and Peterman<sup>6</sup> have reported success with a serum produced in goats which had been inoculated with a diplo-

coccus isolated from patients suffering from measles; other workers<sup>1</sup> have noted no preventive action with that serum. It is now generally agreed that measles is caused by a filtrable virus and that the coccus described by Tunnicliff is a secondary invader. The ease with which parental whole blood may be obtained and the satisfactory results reported by many workers since the introduction of this method by Degkwitz<sup>3</sup> have made it the most common method of prophylaxis in use at the present time; usually 15 c.c. of whole citrated blood obtained from a parent is injected into each buttock of the child.<sup>1</sup>

In attempting to suppress an outbreak in a preparatory school, however, the use of convalescent serum remains the most practical procedure. Park<sup>5</sup> believes that the immunity conferred by this serum will persist for from 2 to 4 weeks, and that in those individuals who develop attenuated cases a permanent immunity will nevertheless be produced. Zingher<sup>8</sup> has pointed out that the infectivity during the prodromal stage is distinctly less in an individual who subsequently develops an attenuated case rather than an unmodified one. The majority of previous reports have dealt with results obtained in children of 3 years of age or less, and the dose which should be given the average

adolescent can only be judged approximately. Park<sup>5</sup> has advocated the use of 6 c.c. of serum for children less than 3 years of age, and 10 c.c. for those 3 years of age or older. Debre<sup>2</sup> suggests a minimum dose of 3 c.c. for infants and would add 0.5 c.c. for each additional 6 months of age, up to a maximum dose of 15 c.c. at 15 years. The serum should be administered before the 5th day of the incubation period; the earlier the serum is given the better is the possibility that the disease will be prevented rather than attenuated. Serum should be obtained from a convalescent individual between the 10th and 40th day following the return of his temperature to normal; a preservative should be added if the serum is not used within a few days.<sup>5</sup>

The present paper reports our experience with the use of convalescent serum in an attempt to control a threatened outbreak of measles in a boys' preparatory school during the winter of 1934.

Table I shows the incidence of measles together with the number of Infirmary days involved during outbreaks at a preparatory school in 1926 and 1929. No convalescent serum was used.

#### METHOD AND RESULTS

On January 1, 1934, C.Y. was exposed to an individual who developed measles on the following day. Upon his return to school he was quarantined, and on January 12 his prodromal symptoms began; the rash appeared on January 16. F.L. and R.D. were pa-

TABLE I

CASES OF MEASLES AND NUMBER OF INFIRMARY DAYS

<i>Date of Onset</i> 1926	<i>Number</i> <i>of</i> <i>Cases</i>	<i>Date of Onset</i> 1929	<i>Number</i> <i>of</i> <i>Cases</i>
April 17 . . . . .	1	February 7... 1	
April 28 . . . . .	2	February 11.. 1	
April 30 . . . . .	1	February 12.. 1	
May 3 . . . . .	1	February 18.. 3	
May 4 . . . . .	2	February 19.. 2	
May 5 . . . . .	1	February 20.. 1	
May 7 . . . . .	1	February 21.. 1	
May 9 . . . . .	2	February 23.. 2	
May 14 . . . . .	1	February 25.. 2	
May 19 . . . . .	1	February 27.. 1	
May 20 . . . . .	2	March 2..... 2	
May 22 . . . . .	1	March 4..... 3	
May 25 . . . . .	1	March 6..... 1	
May 26 . . . . .	1		
May 29 . . . . .	1	Total . . . . .	21
May 31 . . . . .	1		
June 8 . . . . .	1		
Total . . . . .	21		

1926 1929

Total Number of Cases..... 21 21  
Total Number of Infirmary Days.. 251 244

tients in the same infirmary from January 4 to 14 and January 15 to 16 respectively. On January 27, F.L. was re-admitted to the infirmary, and on January 28 his rash appeared; R.D. was re-admitted on January 28, and his rash appeared on January 30. In Table II data concerning these 3 cases are presented.

Table II gives data concerning the cases which might have initiated an outbreak of measles. At the development of cases F.L. and R.D., and because of the failure to quarantine them during

TABLE II

CASES WHICH MIGHT HAVE INITIATED AN OUTBREAK OF MEASLES

<i>Case</i>	<i>Date of Onset of</i> <i>Prodromal Symptoms</i>	<i>Date of Appearance</i> <i>of Rash</i>	<i>Date of</i> <i>Hospitalization</i>
C.Y.	January 12	January 16	January 7
F.L.	January 24	January 28	January 27
R.D.	January 26	January 30	January 28

TABLE III

BOYS RECEIVING SERA CY AND NYC AND CASES DEVELOPING

	<i>Group I</i>	<i>Group II</i>	<i>Group III</i>	<i>Total</i> <sup>1</sup>
Serum given	10 c.c.	8 c.c.	5 c.c.	
Number which received serum CY	8	11	9	28
Number which received serum NYC	11	16	10	37
Number which developed measles	3*	0	0	3

\* Each of these individuals developed an attenuated case; in each instance serum NYC had been given.

the entire prodromal period, it seemed likely that many other cases would develop subsequently. Investigation showed that 66 of the 330 boys in the school had not had measles; their ages ranged from 12 to 20 years. These boys were divided into three groups, graded as to the likelihood of their having been exposed; group I included boys known to have been in contact with F.L. or R.D.; group II consisted of the boys who probably had been exposed; and group III included older boys whose chance of contact was somewhat more remote. The likelihood of contact was based upon seating arrangements in chapel, dining hall, and classrooms, dormitory arrangement, athletic contacts, etc. Such a division became necessary because of the limited amount of serum available, and provided a means of adjusting the dose in relation to possibility of infection.

On January 30 convalescent serum obtained either from C.Y. on the 10th day after his temperature had become normal, or from the Bureau of Laboratories of the City of New York, was given to 62 of the 66 boys in the school who had not had measles; 1 of the remaining boys received the serum on February 2 and 2 others on February 3; 1 boy did not receive serum. The names of the boys in each group were arranged alphabetically and these two sera were assigned alternately; because the supply of serum NYC was greater a somewhat larger number received that serum. Since the prodromal symptoms appeared in F.L. on January 24 and

since R.D. was hospitalized on January 28, it is obvious that serum was given to 62 boys at an interval of from 2 to 6 days following possible exposure. The serum was injected into the upper outer quadrant of the buttock. In Table III will be seen the number of boys who received each dose of either serum, together with the total number of boys who subsequently developed measles.

## COMMENT

In an institution in which there were 66 adolescents who were probably susceptible to measles, convalescent measles serum was used as a prophylactic agent following the appearance of 3 cases of measles in the student body. In such a group, if one is to judge by past experience, at least 25 per cent would probably develop measles before the subsidence of the outbreak. Following the prophylactic therapy, however, only 3 cases of measles developed in this group and each of these cases was in striking contrast in severity to the original cases; in Tables IV and V we have tabulated certain clinical data which will indicate the differences between the unmodified and the attenuated cases.

Despite the fact that no untreated control group was employed in this study, we feel, on the basis of past experience, that the subsidence of this outbreak was due to the use of the convalescent serum; it is unlikely that anyone who has dealt with measles in a similar situation will believe otherwise. The question of proper dosage in

TABLE IV

CLINICAL DATA CONCERNING THE 3 CASES OF MEASLES WHICH MIGHT HAVE INITIATED THE OUTBREAK

Name	Date Rash Appeared	Infirm- ary Days*	Duration of Fever (Days)*		Koplik Spots	Rash	Coryza	Conjunc- tivitis	Bron- chitis	Photo- phobia	Ma- laise	Course
C.Y.	Jan. 16	19	3½	+++	+++	+++	+++	+++	+++	+++	+++	Severe
F.L.	Jan. 28	11†	2	++	+++	+++	+++	+++	++	+++	+++	Moderate
R.D.	Jan. 30	16	2½	++	+++	+++	+++	+++	+	+++	+++	Moderate

\* Exclusive of prodromal period

† Acute appendicitis and appendectomy on 12th day

TABLE V

CLINICAL DATA CONCERNING THE 3 CASES OF MEASLES DEVELOPING IN THOSE INDIVIDUALS WHO HAD RECEIVED PROPHYLACTIC DOSES OF CONVALESCENT MEASLES SERUM

Name	Date Rash Appeared	Infirm- ary Days*	Duration of Fever (Days)*		Koplik Spots	Rash	Coryza	Conjunc- tivitis	Bron- chitis	Photo- phobia	Ma- laise	Course
J.P.	Feb. 10	9	1½	+	+	+	+	+	—	+	+	Very mild
C.S.	Feb. 9	10	2	+	+	+	+	±	—	—	±	Very mild
W.H.	Feb. 21	12	2½	+	++	+	+	+	—	++	++	Mild

\* Exclusive of prodromal period

this age group is difficult to determine accurately. The development of attenuated cases in J.P. and C.S. despite the fact that prophylaxis must have been given them at most within 72 hours following exposure, suggests that they were particularly susceptible. It may be that a larger dose would have prevented these cases, but if one were to judge by this single experience, a dose of 10 c.c. will produce satisfactory results in the vast majority of instances. It is interesting that each of the 3 individuals developing attenuated measles had had serum NYC; it is not unlikely that this serum had a lower antibody content than serum CY which was only 24 hours old.

## SUMMARY

1. In a threatened outbreak of measles in a group of preparatory school boys, 66 of whom had not had measles, convalescent measles serum was used prophylactically. Only 3 cases of measles, all decidedly attenuated, subsequently developed in this group. On

the basis of past experience, at least 25 per cent of this group might have been expected to develop measles.

2. The use of convalescent measles serum is suggested as the most practical method of controlling an outbreak of measles among adolescents in a preparatory school or in a similar situation. A dose of 10 c.c. is considered adequate for members of this age group.

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NOTE—The author wishes to express his sincere appreciation of the coöperation of Dr. W. H. Park who, through the Bureau of Laboratories of the Department of Health of the City of New York, furnished part of the convalescent measles serum in this study.